INSTRUCTION MANUAL

SINE & SQUARE WAVE GENERATOR
MODEL 111A

b.w.d electronics pty. ltd.

MELBOURNE - VICTORIA - AUSTRALIA

[illegible]
ENGINEERING
DEPARTMENT
No.
S.A.I.T.

SINE & SQUARE WAVE GENERATOR

MODEL 111A

HANDBOOK OF PERFORMANCE
OPERATION & MAINTENANCE for
SINE & SQUARE WAVE
GENERATOR
MODEL 111A

1. GENERAL

Model 111A is a compact, wide range sine and square wave generator covering a range of 20 c's to over 1 Mc's.

The sine waveform is of low distortion, particularly over the audio band, and its amplitude is held within ± 1db over the 20 c's to 600Kc's range of frequency.

The square wave has a constant rise and fall time of 0.25 uSec. into a low capacity load and at the low frequency end has a flat top to less than 50 c's with only 5% droop at the low frequency limit of 20 c's.

The first four ranges are in decade steps with a separately calibrated top range. This is coloured red on both panel and dial for ease of reading.

The controls are very clearly marked and operation is straight forward.

In conjunction with an oscilloscope such as B.W.D. Portascope 301, 311, 500B etc., measurement of performance of amplifiers, filters, speakers, transformers etc. can be made from the sub audio through audio and ultrasonic to the video and low Radio Frequencies.

Whilst Model 111A is not a precision signal generator, its wide range and good performance suit it to all classes of work from the laboratory to basic training.

2. PERFORMANCE

SINE WAVE

Frequency Range 20 c's to 1 Mc's in five overlapping ranges.

Range 1 20 - 220 c's.
Range 2 200 - 2200 c's.
Range 3 2 Kc's - 22 Kc's.
Range 4 20 Kc's - 220 Kc's.
Range 5 180 Kc's - 1.04 Mc's.

Frequency Accuracy

Within ± 2% over entire range.

Output	20V RMS into a load not less than 10,000 ohms. Continuously variable control calibrated 0 - 20V and a 4 step decade attenuator.
Output Level	Within ± 1db over 20 - 600 Kc's range falling to less than -3db at 1 Mc's.
Output Impedance	Varies from 0 to 5 K ohms depending on setting of output control on 0 - 20V range. Approx. 600Ω on other attenuator settings.
Distortion	Less than 0.4% from 50 c's to 50 Kc's. Less than 2% from 20 c's to 400 Kc's. Less than 5% at 1 Mc's.

SQUARE WAVE

Frequency Range	20 c's to 200 Kc's. Square wave is available to 1 Mc's but a tilt developes on the waveform over 200 Kc's. Waveform distortion should be allowed for in assertaining results by inspecting waveform before supplying to equipment under test.
Output	20V p-p into a load greater than 10,000 ohms. Continuously variable by panel control approximately calibrated from 0 - 20V. 600Ω impedance on 0 - 2V Attenuator range.
NOTE:	Attenuator is only useable over the entire frequency range on square wave at 0 - 20V and 0 - 2V only. Frequency range must be limited from 20 c's to 20 Kc's if lower attenuator steps are used as distortion appears on waveform above 20 Kc's.
Output Level	Constant over 20 c's to 1 Mc's within ± 1db.
Rise & Fall Times	Less than 0.25 uSec rise and fall times into a capacity load of less than 25 pf. over entire oscillator range.
Low Frequency Tilt	Less than 5% tilt at 20 c's. No tilt above 50 c's.

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3. Power Requirements	220 - 240V 50 - 60 c's. 30 Watts.
4. Size	6½" wide x 9¼" high x 9" deep.
5. Warranty	The instrument is guaranteed against faulty workmanship for a period of twelve (12) months with the exception of the electron valves which are covered by their manufacturer's guarantee.

6. CONTROLS & THEIR FUNCTIONS

MAIN TUNING DIAL Sets the frequency indicated by the engraved cursor on the range selected by the ...

RANGE SWITCH Which selects one of five ranges as shown under the performance specification.

∿ - ⎍ Co-axial Switch selects either sine or square wave output.

LEVEL This control has two functions. In its normal rotational position it sets the output level of the sine or square wave as selected. When turned fully anti-clockwise it switches off the A.C. power applied to the instrument. The indicator lamp at the top left corner indicates whether power is off or on.

ATTENUATOR Attenuator output signal in decade steps and in conjunction with the LEVEL control permits selection of any level from 1mV to 20V.

OUTPUT TERMINALS Two terminals across which the output signal appears. Red terminal is the signal or live connection, whilst the black is grounded to the chassis.

7. OPERATION

For first time operation, check that all controls are functioning correctly and that the instrument appears in correct working order.

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Switch Output Level control to A.C. OFF, Attenuator to 0 - 20V. Range switch to 2 Kc's to 20 Kc's range, Waveform to Sine Wave and Vernier dial to centre of calibrated scale. Connect power cable to suitable 3-pin 220-240V A.C. outlet and switch on by rotating Output Level control. Leave control at minimum setting.

Connect either an oscilloscope or suitable amplifier to Output Terminals and increase output until it is readily visible on oscilloscope or can be heard through a loudspeaker connected to the amplifier. Model 111A will drive a 15 ohm speaker directly but only at low volume.

Now rotate vernier dial and change ranges to familiarise operation of the instrument. If an oscilloscope is being used to check the waveform, switch to square wave after checking the sine wave output and check the operation of the oscilloscope with the square wave, noting particularly whether it will display the waveform without loss of rise time. All B.W.D. oscilloscopes have a higher rise time than the oscillator and will display the true waveform.

To use the oscillator to check an amplifier, connect a lead from the block terminal to the amplifier chassis and another from the red terminal to the amplifier input. Select the range required and with an output level meter, an oscilloscope or wide range A.C. meter, monitor the output, making sure that only sufficient input level is used to enable the output measurement to be obtained and that no overloading occurs - this is readily seen with an oscilloscope but can pass unnoticed with a meter which will give false results. When a suitable level has been selected at, say 1000 c's, tune the oscillator over the range of 20 c's to say, 20 Kc's or higher if it is a wide band amplifier, and the associated measuring equipment will accommodate these frequencies and plot the output level on a graph. As the input is constant the resultant graph will be the response of the amplifier under test.

If any doubt exists as the response of the associated measuring equipment, feed the oscillator directly tino the meter or oscilloscope and check its response and allow for any variations that occur in the final result.

Square wave checking of amplifiers can only be carried out if an oscilloscope is used in conjunction with a suitable load across the amplifier output. A perfect amplifier will pass a 1000 c's square wave with little deterioration in shape,a poor high frequency response will be shown by a definite rounding of the leading edge, and ringing is an indication of instability usually due to phase shift in feedback loops. At the low frequency only an exceptional audio amplifier will pass a 50 c's square wave without a large amount of tilt appearing on top and bottom of the waveform.

Checking other equipment such as filters, transformers etc. can be carried out in a similar manner to the foregoing description of amplifier response checking.

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NOTE: As the output terminals are connected to ground through a low resistance - 1000 ohm max. no direct connection between the output terminal and any point which has a D.C. potential on it should be made unless an isolating capacitor of suitable working voltage and capacity is used between the terminal and point of connection.

8. CIRCUIT DESCRIPTION

V1a & b together with the components associated with them form a Wein Bridge oscillator, the frequency determining components are C1a & b which is the vernier control and R1-10 providing the ranges selected by switch S1a & b.

The frequency determining network connected between V1b anode and V1a grid feeds only one frequency back into V1a grid in the correct phase necessary to maintain oscillations. This frequency may be continuously varied over a 10-1 range by the capacitors C1a & b which have a 10-1 capacity change and resistors R1-R10 are decade values which also change the range by X10 factor.

To maintain a constant, low distortion output, negative feedback is employed within the feedback path via RV1 which feeds back the same signal to the cathode of V1 that the Wein Bridge network feeds to the grid.

A 15 watt lamp is used in the cathode of V1a instead of a resistor. This has the property of increasing its resistance with increase in signal level and therefore varies the impedance in the valve cathode and maintains a constant output by change of degeneration.

Output from V1b anode is taken to V2a & b via C5. When S2a & b is in the sine wave position V2a & b are connected as parallel cathode followers with their grids in parallel and the output taken to the Output Level control from the common cathode load at low impedance. With S2 switched to Square wave V2 is operated as a very slow self running Schmitt Trigger, triggered by the incoming sine wave from V1b at the repetitive rate determined by the Wein Bridge oscillator. The output waveform is developed across V2b anode load and coupled through C8 to RV2 output control.

The power supply is a normal full wave rectified supply followed by a capacity resistor filter. Separate filtering is used for the oscillator V1 and output stage V2 to ensure the greatest stability and lowest hum content in the output waveform.

9. MAINTENANCE & ADJUSTMENTS

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Other than a valve change, little or no maintenance is likely to be required on Model 111A.

RV1 may need re-setting to compensate for valve changes after prolonged use. It is adjusted to set the output waveform to 20V RMS when the Output Level control is set to the 20V calibration position on the level control.

Trimmers C2 & 9 to 15 are set to obtain correct calibration with greatest constancy of level.

Valves may be changed and replaced with no effect on the performance of the instrument. No re-setting of RV1 should be necessary with change of valve.

Valve Types.

V1	6GV8
V2	6BQ7A, 6DJ8, ECC88
V3	6V4 or EZ80.

Dial lamp, 7.2V 100mA MBC.

When it is necessary to replace components, locally available alternatives may be used if exact replacements are not to hand, provided the physical size and quality are the same. It is, however preferable to use exact replacements whenever possible, and these can be ordered directly from B.W.D. Electronics Pty. Ltd., 67-69 Burwood Road, Hawthorn, Victoria, Australia.

Every effort is made to keep this handbook and circuit up to date but the right is reserved to adjust the valves or amend the circuit without notice.

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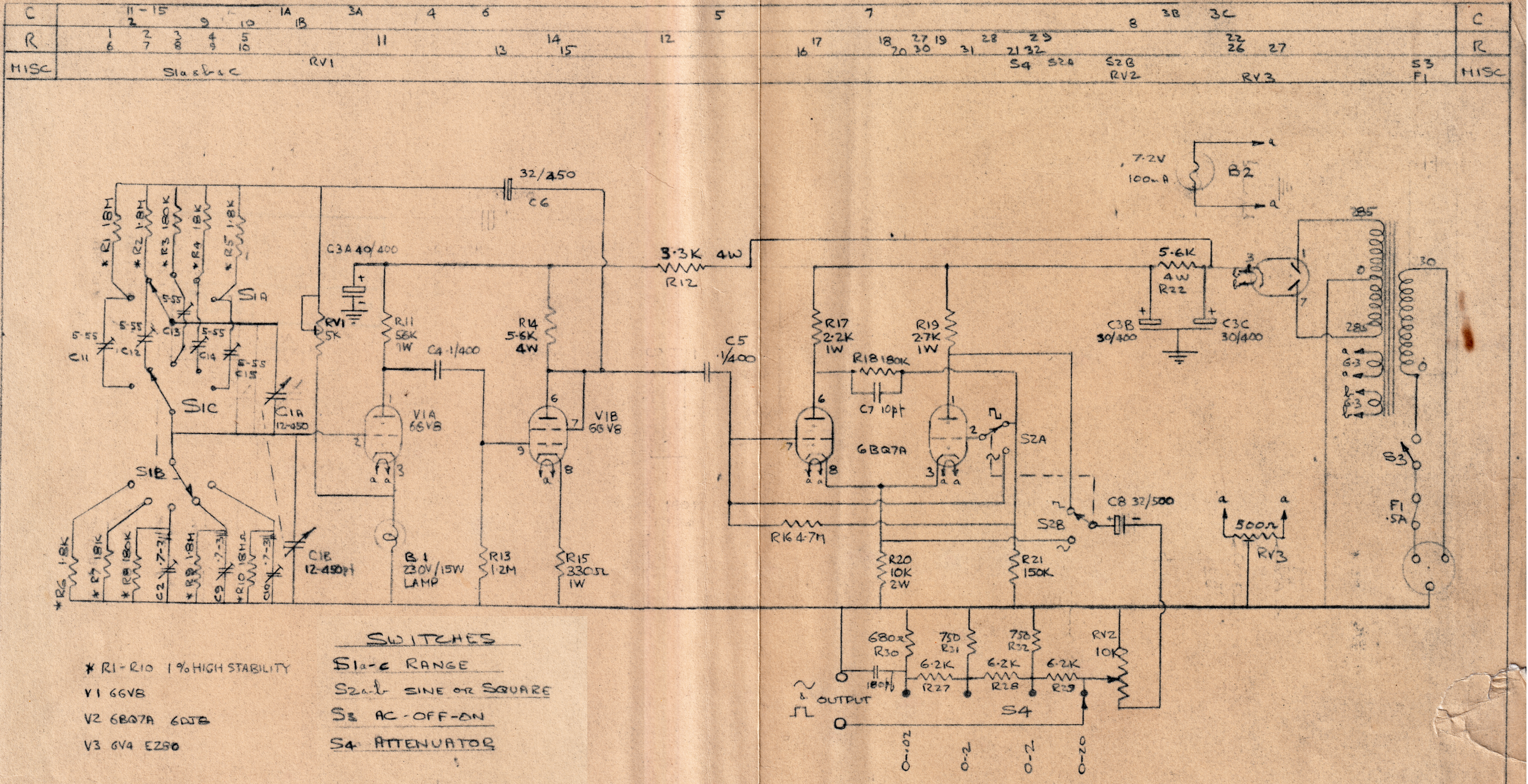

* R1-R10 1% HIGH STABILITY

V1 6GV8

V2 6BQ7A 6DJ8

V3 6V4 EZ80

SWITCHES

S1a-c RANGE

S2a-b SINE OR SQUARE

S3 AC-OFF-ON

S4 ATTENUATOR

CONTROLS

RV1 FEEDBACK

RV2 OUTPUT LEVEL

RV3 HUM BALANCE

ISSUE	1	111A	B.W.D. ELECTRONICS PTY. LTD MELB. AUSTRALIA	DRG NO
DATE	8/63	Drawn JB	MODEL 111A SINE & SQUARE WAVE GENERATOR	269A